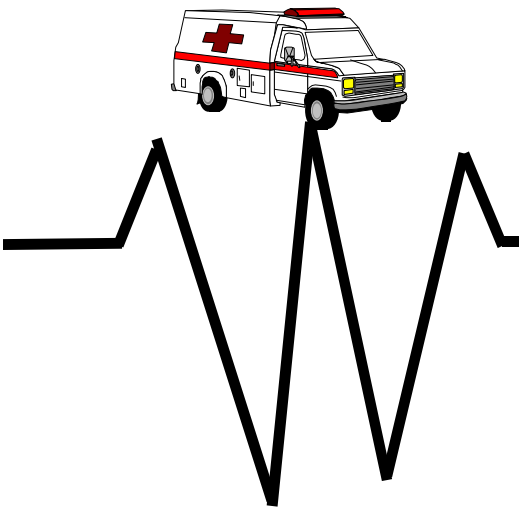

Innovative Perspectives

On Planning for Transportation Disruptions Following Future Earthquakes in the San Francisco Bay Area

ABAG asked a number of local government officials, transportation providers, utilities and businesses to speak at the five subregional workshops. They discussed:

- the major issues, interagency dependencies, and areas of potential conflict they have experienced or anticipated facing as they struggled to address the transportation impacts after a large earthquake, and
- some innovative ways in which their organization is addressing these issues.

The following pages summarize their remarks. These papers represent of variety of thoughtful insights into transportation problems and their potential solutions.

The first paper is by Sarah Nathe, a planner with the Governor's Office of Emergency Services, whose perspectives are based, in part, on her first-hand experiences in Kobe, Japan, the day after that earthquake.

The next five papers are by emergency coordinators and public works officials of Bay Area cities and counties. They share their experiences with flooding, fire, and the Loma Prieta earthquake, including both what has worked and where they have experience problems.

Then, Sandy Stoddard of the Sonoma County Chapter of the American Red Cross – Bay Area, discusses some of the logistical problems they have had in past Bay Area disasters and how he views post-earthquake transportation issues.

The next five papers were prepared by transportation providers – an airport, airlift volunteers, Caltrans, the California Highway Patrol, and a transit operator.

Representatives of two utilities – Pacific Bell and Pacific Gas and Electric Company – prepared the next two papers. It is a measure of the recognition of these two companies of the interrelationships among transportation, communications, and power that these two utilities also contributed to the funding of this educational effort.

The final three papers were prepared by representatives of three private companies. They describe the effort of UPS both internally and with the American Red Cross to move goods after disasters; the Chevron Rally Plan to facilitate emergency communication for Chevron employees, their families and the company; and the experience of Intel during the Loma Prieta earthquake.

Post-Earthquake Transportation: Dilemmas for Emergency Management

Sarah K. Nathe
Senior Program Planner
Coastal Region Earthquake Program
California Office of Emergency Services
Oakland, California

It may be a truism to say that effective emergency response requires mobility and access to damaged areas, but it doesn't hurt to emphasize that fact as we contemplate the probable transportation impacts of scenario quakes for the Bay Area. If these estimates are even somewhat accurate, access and mobility are going to be severely limited, and emergency responders will be hampered in getting to where they are needed. Such a realization has prompted California OES, in concert with some counties and cities, to examine our assumptions about response capabilities after a quake, and to change the ones that are obviously incorrect. We believe we are now basing our plans for response on some realistic, if ominous, premises and observations.

The geography and topography of the Bay Area limit access to the region and mobility within it. Major transportation routes are on poor soils, cross major faults or bodies of water, and run through narrow corridors with infrastructure such as gas pipelines and hazardous materials plants. And we refer here not only to roads and highways; rail routes, airports, and harbor facilities are in the same vulnerable areas. With all transportation systems in such perilous locations, they can be closed by any number of earthquake impacts: fault rupture, shaking, landslides, and liquefaction; or by secondary effects such as fires, the collapse of other structures, or hazardous materials releases.

These multi-modal points of failure will make it very difficult to get emergency responders to serious incidents. And surface arterials that are not closed by the impacts mentioned above will quickly be congested and/or gridlocked by the traffic that will flow onto them from closed routes. Fire fighters, emergency medical personnel, urban search and rescue squads, law enforcement officers, and utilities repair teams will be delayed or prohibited from going where they need to go in the first minutes and hours. It may be virtually impossible to transport injured people to hospitals, except by helicopter. Debris removal, which must begin almost immediately after a quake, will be complicated by an inability to get heavy equipment into the affected areas. Care and shelter for survivors won't be provided efficiently if government and voluntary agencies can't send personnel and supplies into the places where they are needed.

Repair and opening of some of the disrupted roads will be one of the highest priorities, for without them, nothing else can get done. Also critical will be traffic control and the limiting of some open routes to emergency responders only. Responders may be required to use creative and flexible methods of surface transportation such as motorcycles and bicycles, water transport should be quickly pressed into action, and transit systems and schedules must be reconfigured and revised in order to both carry customers who routinely rely on them and to relieve some of the automobile congestion that will otherwise result.

City and county governments will bear the immediate burden of response within their jurisdictions because the assistance they might get from mutual aid systems or state agencies will inevitably be slowed by lack of access and mobility. The state and federal governments will

stage people and supplies on the periphery of the area--for example, at Travis AFB in Fairfield--and begin to move them into the Bay Area using helicopters and boats. But all of this will take time—perhaps days. All the more reason for cities and counties to promote the formation and training of neighborhood response teams.

We have not had transportation disruptions of this magnitude in our two recent major quakes in California. Though both the Loma Prieta and Northridge earthquakes caused dramatic and photogenic damage to some roads and bridges, neither of them closed large numbers of surface roads or rendered emergency responders immobile. There were plenty of alternate routes for fire engines, ambulances, and public works vehicles to use.

The 1995 Kobe, Japan, earthquake may best illustrate the amount of traffic chaos we could experience in a Bay Area temblor. In that magnitude 6.7 quake, major freeways and highways, most bridges, railroads and commuter trains, and port facilities were seriously damaged and closed immediately and for some time thereafter. For a number of days there was no governmental attempt to control traffic or limit the few open arterials to response purposes. As a consequence, there was gridlock on most routes into the damaged areas, emergency vehicles were bogged down in it, as were the pieces of heavy equipment needed to clear away the debris that had blocked some of the routes in the first place.

Among the primary and secondary earthquake effects that disrupted transportation were fault rupture, excessive shaking, liquefaction, landslides, structures (elevated freeways and train tracks, buildings) that collapsed onto roads and blocked them, utility poles and trees, fires, and traffic. Getting people to hospitals was next to impossible. The port facilities were extensively damaged by liquefaction and it was a day or two before even small craft could dock at makeshift docks along the collapsed quay walls. The two airports in the area were useable by planes, but surface traffic couldn't easily reach them on the closed or congested roads and streets. A week after the quake there was a crisis with some of the 5000+ dead bodies: transporting them to nearby crematoria was going too slowly because blocked roads limited the number of trips that could be made.

Our own recent experiences, our observations of Kobe's problems, and our damage scenarios have obvious implications for Bay Area transportation and emergency planners at all levels of government and in the private sector. It is quite apparent that we will face serious difficulties in getting from Point A to Point B following a major earthquake. The better we can anticipate and think through the obstacles we may have, the more efficient will be our response, and the additional lives and property we will save.

Transportation in Disasters: The Sonoma County Experience

Sandy Covall
Emergency Services Coordinator
Sonoma County Department of Emergency Services
Santa Rosa, California

Introduction

Sonoma County, the northern most of the nine counties comprising the San Francisco Bay Area, is located along the Pacific coastline about 40 miles north of San Francisco and the Golden Gate Bridge. The County is just over 1500 square miles, making it the largest of the nine Bay Area counties. Sonoma County has a population of 432,222.

Transportation

The primary travel corridor is Highway 101 (running north and south) along which 70 percent of the population lives. This is the main economic and transportation corridor for the County and entire North Bay, as well as the main tourist route through Northern California. The east/west travel is Highway 12 connecting the City of Sebastopol in the west with the City of Sonoma in the east out to Interstate 80 in Solano County. Hwy. 116 links the City of Sonoma to Rohnert Park/Cotati, Sebastopol, and the Russian River area. Hwy. 37 runs east-west through the southern portion of the County with a large amount of commercial and passenger traffic. Of note is scenic Highway 1 (the Pacific Coast Highway) running along the coastline connecting Marin and Mendocino counties. All other roadways in the county are two lane rural roads or surface streets. Other means of transportation include:

- the Northwestern Pacific Railroad running through the County parallel to Highway 101 and a secondary line running through the southeast section of the County connecting the City of Sonoma to the Bay Area
- the Sonoma County Airport which serves as the regional commercial connection for passenger and freight service. Four other small municipal airports are located in the cities of Sonoma, Petaluma, Healdsburg, and Cloverdale
- Bodega Bay Harbor is home to commercial fishing and charter boats

Threats

Sonoma County is threatened by a multitude of potential disasters including flooding, winter storms, earthquake, urban/wildland fires, dam failure, landslides, hazardous material incidents, tsunami, drought, freeze, as well as isolated events that could affect the tourism, agricultural, dairy, and fishing industries. In the last 20 years the County has experienced all these events except for tsunami and dam failure.

Sonoma County has been widely recognized as a good place to sell umbrellas. Sonoma County's Guerneville/Russian River Area and the City of Petaluma have the highest repetitive flood loss rate in California. Sonoma County activated its Emergency Operations Center (EOC) in the 1995 Winter Storms (DR 10-44/46), large storms in December 1995 and February 1996, the Cavedale and Porter Creek Wildfires in August 1996, the New Year's Flood of 1997, as well as the 1998 El

Nino Flood and Rio Nido Slide incidents. Forward Incident Command Posts have been activated in 1995, 1997, and 1998.

Transportation in Emergencies

To manage the transportation issues, the Russian River Flood Response Plan has been developed to ensure that as waters rise, local residents can see if there transportation routes will be open or closed. They can do so by comparing river level forecasts with a checklist of local landmarks. For example, if the water is forecast to rise to 34 feet, the matrix translates this as meaning the PeeWee golf course will be flooded. This information allows the residents to get out before they are trapped.

In addition a formal road closure schedule has been developed in conjunction the California Highway Patrol. As the water rises to certain levels, it triggers the closure of pre-determined roads. This prevents tourists and others from entering the area and gives confidence to evacuating residents that their areas are secure. Once the waters recede, a formal re-entry pass system is initiated to keep the curious out.

During the Rio Nido slide event, over 145 homes were evacuated in the immediate area and entry restrictions were placed on an area that covered another several hundred homes. A temporary pass system using an inside window decal with the vehicle license plate number on it allowed residents to enter the area without having to stop and show ID each time.

The need for dedicated emergency vehicle routes is clear following the most recent urban earthquakes - most notably Kobe, Japan. While it is difficult to select specific routes due to the unknown extent and location of damages which will follow the next major earthquake, it is important to anticipate closure of the primary traffic routes and plan for alternates. Production of maps showing potential routes and marking signs would greatly speed the implementation and effectiveness of such routes. When selecting potential routes it is critical to coordinate with local law enforcement, the CHP, and Public Works. Lastly, the potential routes must themselves be survivable - bridges that have not been seismically retrofitted pose the greatest threat. A regional approach to designating such routes and standardizing the marking systems would be most effective in speeding aid to the most impacted communities.

Transportation in Disasters: The City of Napa Experience

Frank Prim
Operations Manager
Public Works Department
City of Napa, California

The City of Napa has experienced numerous floods, so we would plan to draw on those experiences if an earthquake were to affect our city.

A city being cut in two due to fault damage to roads or major freeway damage is, in a sense, similar to a city being cut in two by a flooded river. We set up two emergency operations centers, one on each side of the river, and open the routes crossing the river last. We would plan to do the same in an earthquake situation.

Working three eight hour shifts works well since the disaster will last more than a couple of days. Dealing with a disaster on an on-going basis can be extremely stressful. In addition, it is better to continue with the same shift for the entire disaster, if possible. Then sleep patterns can be maintained. It is difficult to change from regular to night shift work, or work through both. This pattern also means that staff are more likely to be ***alert*** in the emergency situation and able to respond to crises.

The "Street Closure and Barricade" map and closure system allowed barricading to take less than an hour, and was an excellent addition to the City's flood preparedness. A larger area was barricaded than necessary, but it is easier to make the barricade area smaller than larger once it is established. We have examined some of the legal issues related to pre-designating priority roads. It is far safer, from a legal standpoint, to pre-designate your priorities for inspecting routes.

The media become an integral part of any disaster operation. The City issued fifteen press releases between Monday, February 2, 1998 and Friday, February 6, 1998. It was extremely important to record not only the date, but also the time of each press release since information was changing and being updated rapidly.

There will be tourists, as well as residents, in your community when disaster strikes. Therefore, it is important to provide maps showing not only road closures, but also suggested detours and routes away from the disaster area.

It is important to look at what you will do both if you are at work ***and*** if you are at home, for you are more likely to be at home than at work. Transportation and communication are key in both instances.

Transportation in Disasters: The City of Oakland Experience

Henry Renteria
Emergency Services Director
City of Oakland, California

Our experience with disasters dates back to the 1991 fire and the 1989 Loma Prieta earthquake. We also had extensive damage in the El Niño storm of early February 1998.

In 1992, the citizens of Oakland passed a $50 million bond, which averages $15 per $100,000 of assessed value per parcel per year for thirty years. We are spending the money on police and fire equipment. In particular, we have a new Emergency Operations Center (EOC) and a new communications system. Communications is key. We are spending $7 million on our new system. It consists of a 800 megahertz radio system for police, fire and public works. We also have established a new geographic information system (GIS) and emergency information system (EIS). The GIS includes over 85 layers, including freeways, streets, sewer lines, schools, hospitals, and handicapped citizens residences. Police and fire also have a computer-aided dispatch (CAD) system. Police and fire are discussing the possibility of adding GPS units to their vehicles to aid in tracking for emergency response. The units are controversial, however, and have brought up several personnel issues.

In future disasters, the City will uses SEMS. The City believes that strong relationships are key to a strong response capability. We have built strong relationships with the American Red Cross, Community Agencies Responding to Disasters (CARD), utilities (including PG&E and EBMUD), transit agencies (including BART and AC Transit), the Oakland Unified School District, the State Office of Emergency Services (OES), the Alameda County OES, and the Federal Emergency Management Agency (FEMA).

Impact of Earthquakes on the City of San Jose's Infrastructure

Frances E. Winslow, Ph.D., CEM
Director, Office of Emergency Services
City of San Jose, California

The ABAG shaking intensity maps form the basis for much of our post-earthquake transportation planning in San Jose. ABAG maps for San Jose show shaking intensity levels of 8 and 7 for most of our community, meaning that careful planning and aggressive mitigation can result in little or no damage to private homes and industrial buildings. However, the maps also show that the freeway system could sustain shaking intensities of MMI X, possibly causing not only damage to the freeways themselves, but also blockage of city streets with freeway debris.

The City of San Jose has developed a ***Multi-Hazard Emergency Response Plan*** based on the Incident Command System and the Standardized Emergency Management System. In this plan the ***Construction and Engineering Unit*** of the Operations Section would conduct damage assessment of all public facilities, including city streets. Their resources immediately after an earthquake would include ***Streets and Traffic Department*** staff members who were working throughout the community, and would contact the ***Emergency Operations Center*** (EOC) using the municipal radio frequency. In addition, members of ***San Jose Prepared!***, our community emergency response team, include city streets in their neighborhood damage assessment information, which they forward to the EOC through phone, fax, amateur band radio or packet systems. ***Police and Fire*** personnel responding to calls for assistance, and providing damage assessment of their patrol areas, would provide information on road conditions to the EOC through their VHF and UHF radios. Finally, San Jose has a network of intersection cameras that can be remotely operated. If this system is functioning, a considerable amount of data could be collected for most major intersections, and the areas immediately adjacent to them. The ***Department of Streets and Traffic*** has a detailed Standard Operating Procedure (SOP) for their department personnel to activate the collection of damage assessment information, and the commencement of mitigation and recovery activities. Police and Fire departmental SOP's also address their roles in reporting damage and mitigating community effects.

Emergency response steps include providing intersection control through barriers and delineators, and personnel to direct traffic at critical intersections. Stop signs will not be used, as they can conflict with the signal system when it is working or is restored, and cause accidents. Stationary electronic signs at major intersections can be used to direct traffic around major obstacles to traffic circulation. Removal of debris from major streets will be another high priority. Circulation of public safety vehicles is critical for life safety in the community. Since many areas of the city have underground utilities, the street light poles and street trees are the most likely sources of road blockages. Roadways that pass under freeways or railroad crossings may have debris from the over crossing bridges deposited in the right of way, so concrete may have to be removed, as well. Power lines will also be a concern in the areas of the city where they are still above ground, and in areas where high voltage lines cross roadways. The Construction and Engineering Section's utility coordinator will work with Pacific Gas and Electric to secure these lines.

San Jose's public transit system is run by Valley Transit Authority (VTA), and consists of a light rail system and busses. The city's staff will coordinate with VTA for timely clearing of city streets within San Jose's jurisdiction that are mass transit routes.

Amtrak and CalTrain rights of way both pass through San Jose. Construction and Engineering staff will coordinate with these rail service providers for restoration of services within the city. San Jose International Airport, an enterprise fund of the City of San Jose, has its own disaster recovery and business resumption plans, which would be coordinated with the Construction and Engineering Section. San Jose Airport is the only major Bay Area airport not built on Bay mud. It may be the only airport operating to receive relief supplies and workers for several days. Development of safe transportation routes from the airport to the affected parts of the community will be a high priority.

During the floods of 1995, 1997 and 1998 there were some street closures in San Jose. Minor flooding did not create an impediment to the passage of city vehicles, so no mitigation steps were taken. Areas with deeper water had "flooded intersection" signs posted as a warning to motorists. A few intersections suffered major flooding, such as First and Montague, where a manhole cover was blow off by the power of the water in the storm drain system. Damage to the roadway surface is the second most likely cause of intersection closure, after debris.

In the case of floods, the end of the storm and the lowering of the water levels in the rivers allows the storm water to drain out of the community, resolving most intersection blockages. In some cases flood-borne debris, such as mud, grasses and tree parts, had to be removed from the right of way before traffic circulation could be restored.

After an earthquake it is likely that blocked roadways will be a greater problem than after floods. It is likely to take days to remove concrete, light poles and other debris from roadways. The initial effort will be directed at major roads needed for emergency response. The general public will have to seek alternate routes, or more likely, alternate means of transportation. We advise everyone to have pre-mapped several routes from their homes to key facilities, such as hospitals, pharmacies, food stores, and their work location. We also suggest that people consider using bicycles, roller skates or other small vehicles for essential trips in the first days following an earthquake.

The lessons from Kobe showed the critical importance of limiting access to the community. In Kobe passable roadways became blocked with the private vehicles of relatives and friends wanting to help disaster victims, thus making it impossible for public safety vehicles and medical vehicles to reach the injured. Therefore, the Police Department has a traffic control plan to strictly limit the use of selected roads into damaged areas and around critical response facilities (such as hospitals) to assure that the victims are served as efficiently as circumstances permit. The County's Multiple Casualty Incident Plan also provides for the coordination of air resources, such as medical helicopters, to serve the community. Large roads might need to become landing zones. Streets adjacent to fields or other areas selected as landing zones might have to be closed to vehicular traffic.

San Jose is prepared to respond to the transportation needs of the community after an earthquake. We believe that the basis for an effective response is an educated public, and we strive for this through ***San Jose Prepared!*** and our web site. We also believe that an up-to-date plan that is well understood and exercised is a key component of disaster response success. We try to practice these principles.

Transportation in Disasters: The City of San Francisco Experience

Rich Cunningham
Public Works Department
City of San Francisco, California

Our problems in the Marina District following the 1989 Loma Prieta earthquake were merely a "pilot" disaster. We produced a video based on that experience appropriately named "It Wasn't the Big One." Roads were heavily damaged due to liquefaction. Utilities were also heavily impacted. The domestic water supply was non-existent and PG&E shut off natural gas to stop the potential for fires. Luckily we had no wind. There were a total of eight building collapses.

Social problems were particularly tricky. We had to deal with private property owners, the media, tourists, and politicians. Thus, we had to focus on perimeter control for an extended period of time – not something the police are typically forced to do. We eventually switched perimeter control to the Conservation Corps and the military.

We also had to deal with building demolition decisions. We categorized buildings into two groups:

1. those posing a life, health or safety problem (meaning the buildings had literally fallen into the street); and
2. other buildings red-tagged as uninhabitable, but which had not collapsed into the street.

The second group of buildings offered an opportunity for the owners engineer and our engineers to reach a joint conclusion. Interestingly, our engineer often agreed with the owner's engineer; the arguments were between the owners and their engineers!

As a result of this experience, we now have established priority routes for re-opening. We have South Van Ness and Van Ness on the list, not Market, due to the likelihood of buildings impacting the streets. We plan to clear routes based on these priorities. We have also trained our crews not to get involved in local rescue operations, but to rely on mutual aid crews and the military for those tasks. We stress that rescue cannot occur without clear routes and our intelligence or information capabilities. We now use a four-color coding system to organize that information:

- blue – unknown status
- red – impassable
- yellow – passable for emergency vehicles only
- green – open

Our maps will also show the condition of streets, the condition of buildings, and the condition of the street structures.

We also now plan to obtain an open cell phone line to the media – and not hang up. Back-up communication also consists of low-band radios which don't require as many repeaters as the high-tech high frequency equipment.

The Impact of Transportation Disruptions on Mass Care: Some Perspectives of the Red Cross

Sandy Stoddard
Disaster Services Director, Sonoma County
American Red Cross – Bay Area
Santa Rosa, California

The Sonoma County Chapter of the American Red Cross is responsible for providing mass care (sheltering and feeding) and emergency assistance (replacement of lost living essentials) in the aftermath of a major disaster in Sonoma County. When a large disaster occurs within any chapter's jurisdiction, it can rely upon a system of mutual aid from other area chapters, the state Red Cross organization and ultimately from a national disaster response structure. This support can consist of supplies, equipment, trained manpower and financial support.

If a major (7.0+) earthquake occurs on the Rodgers Creek fault, the ability of the local chapter to respond effectively will be severely impaired. Limiting this discussion solely to transportation factors:

- First of all, the Red Cross depends on the activation of a network of trained volunteers to man a disaster relief operation. Many of these volunteers and/or their families will be victims. Even if sufficient numbers of them are unhurt and available to respond, road closures within the County and massive traffic jams on open roads will severely limit their ability to react in a timely fashion.
- Secondly, Red Cross mutual aid assistance from outside the County will be severely impacted by major disruptions to access highways and roads. U.S. 101, the primary artery into the County from the north and south, will probably be subjected to multiple closures. Access from the east, limited normally to a relatively few number of primary roads by topography, will be greatly hindered by closures, as well. The major source of immediate Red Cross assistance in support of the local chapter would normally come from the Bay Area. The Bay Area itself will probably have more than it can handle with damage there from a rupture of the Rodgers Creek Fault. Even if assistance were immediately available from that area, the major bridges into the North Bay region could very well be closed to traffic.

A 1996 ABAG study predicted that the 7.1 magnitude Rodgers Creek temblor would render 13,669 dwellings uninhabitable in Sonoma County. The Red Cross will be responsible for opening and operating emergency shelters to accommodate county residents who have no other lodging alternatives. Transportation disruptions will not only severely limit the ability of the Red Cross to staff the needed shelters with volunteers, but also will make their ability to move emergency shelter supplies (such as cots and blankets) very difficult. Food supplies will have to be moved via road to shelters as well as a myriad of other emergency support materials (from medical supplies to toilet paper). This dependence on logistical support by road will put operations in jeopardy. With most communications cut, vehicular courier service will also be necessary to link the Red Cross Emergency Operations Center with its relief facilities and with county and local emergency service agencies. It too will be obviously limited by road closures.

The Impact of Earthquakes on an Airport: Some Experiences and Planning by the San Jose International Airport

Constantino Herrera
San Jose International Airport
San Jose, California

The Day of the Loma Prieta Earthquake

At San Jose International Airport - The airport immediately conducted airfield and terminal inspections. The airport was closed until the damage assessment was completed. All runways and taxiways, as well as associated lighting systems, were inspected. Aircraft parking ramps were also inspected. The aircraft fire and rescue support were evaluated. The operational status of the Air Traffic Control (ATC) tower, other ATC facilities, and aircraft navigational aids were verified. Both terminals, automobile parking garages, and lots were inspected. The damage assessment of the airport showed no significant damage. However, commercial power was out; generator power for terminals and airfield lighting was used. The airport was fully operational 40 minutes after the earthquake.

Activation and Coordination of Airport Resources – The airport determined the status of access routes, including:

- Guadalupe / Hwy. 101 overpass;
- Coleman / I-880 overpass; and
- De La Cruz / Hwy. 101 overpass.

The airport also verified the operational status of other Bay Area airports (that is, SFO and OAK). We determined aircraft fueling capabilities. Then we advised the OES coordinator of the airport's operational status. We activated the Airport Command Post to coordinate and communicate with the City Emergency Response Center.

FAA Airport Emergency Response Guidelines

FAA Certificate Part 139 Airport – Air Carrier Airports – The Federal Aviation Administration requires certification if an airport has commercial aircraft with more than 30 seats operating at an airport. The guidelines specify what is contained in the Airport Certification Manual. The Manual is mandatory. The manual has operating procedures for aircraft and passenger safety. It requires an Airport Emergency Plan for aircraft emergencies, terminal incidents, and natural disasters (such as earthquakes and floods). The emergency plan is evaluated and approved by the FAA.

Lessons Learned – We found out that our plan worked. However, we were not really tested for we did not suffer significant damage to our infrastructure from the earthquake. We did see that our communication and coordination with outside organizations could be improved. This change would ensure that all available aviation resources can best be used to serve the needs of the surrounding communities. We are currently evaluating and exploring a better communication system, improved procedures, and training of staff (both within and outside our organization). These improvements will be added to the Emergency Plan which is currently being revised and updated.

San Francisco Bay Area Earthquake Airlift Volunteers: A Special Project of the California Pilots Association

Jay C. White
President
California Pilots Association
San Carlos, California

During the week following the 1989 Loma Prieta earthquake, small aircraft based at Bay Area Airports were called into service. During that time they carried some 300,000 pounds of emergency supplies to the hard-hit towns of Watsonville and Hollister. This airlift was an interim action that took place while official agencies such as FEMA and the Red Cross were preparing for a full response.

There are approximately 2000 small aircraft based at Bay Area airports. These aircraft are a valuable resource for post-quake relief. They are particularly adaptable to quick response within hours for transportation of personnel and emergency supplies.

Certain Bay Area cities and counties currently include small airports in their emergency plans. Those that do not can still take full advantage of small aircraft as a resource. Airport personnel and aircraft owners can coordinate an airlift and provide relief services on a volunteer basis. This requires no official participation by a governmental agency. Each flight by a volunteer pilot will be conducted as the pilot's personal flight will be the sole responsibility of the pilot.

All Bay Area cities and counties are urged to include airports and small aircraft in their post-quake emergency plans. More information on this program can be obtained by contacting the local airport manager, or the Earthquake Airlift Volunteers.

Transportation After Earthquakes: The Role of the California Department of Transportation (Caltrans)

Sean Nozzari and Chan Newlander
Traffic Systems
Caltrans District 4
Oakland, California

Caltrans has established a set of emergency response policies which include:

- minimize the loss of life and property;
- protect State-operated facilities and the State highway system;
- maintain and provide up-to-date damage and operations information to the public, the media, local jurisdictions, the Governor, and State legislators, as necessary;
- open damaged State transportation system components as soon as possible;
- cooperate with other key agencies at the local, State and federal levels;
- support the State emergency-response efforts by the California Governor's Office of Emergency Services (OES), the California Highway Patrol (CHP), and local jurisdictions; and
- conduct periodic drills and exercises in cooperation with other public agencies.

Caltrans' typical emergency response activities include:

- planning and implementing long-term traffic control and evacuation plans in cooperation with the CHP;
- assessing damage to State highways, as well as disseminating timely and accurate information regarding the status of those highways and available detours;
- activating Caltrans Emergency Resource Center (ERC) and staffing other State and local emergency centers;
- establishing route recovery plans;
- implementing emergency contracts for highway reconstruction;
- providing engineering and technical assistance to OES and other State and local government agencies relative to transportation services;
- establishing a liaison with the Federal Highway Administration regarding the status of the highway system;
- supporting local public works departments; and
- soliciting general aviation support.

Caltrans' emergency response priorities may generally be summarized as:

- traffic control;
- damage assessment; and
- route recovery.

In addition, Caltrans has emergency response resources, available in the event of an emergency, including:

- a 24-hour Transportation Management Center (TMC) with access to Bay Area broadcast and news agencies;
- a Communications and Dispatch Center;
- an Emergency Resource Center with emergency power, water, and supplies;
- transportation engineering, highway maintenance, and public information personnel to staff command post(s);
- traffic control devices such as barricades, cones, highway signs, and arrow boards;
- traffic management and highway maintenance equipment;
- mobile satellite and other communications systems; and
- on-call HAZMAT, freeway service patrol and emergency construction contractors.

Transportation in Disasters: A Perspective of the California Highway Patrol

Lieutenant Wayne Butler
California Highway Patrol
Martinez, California

The maintenance of major transportation routes in the event of a disaster is crucial for the movement of emergency responders, search and rescue for the injured, and the feeding and recovery of the general population.

The California Highway Patrol is a statewide law enforcement agency which specializes in traffic management. There are approximately 6,800 officers in 115 offices throughout the State of California. These officers regulate the commercial transportation industry in regards to traffic safety. They are extremely mobile, for the CHP can deploy 100 officers within 1 hour, and over 1,000 officers anywhere in the State within 6 – 12 hours. Approximately 25% of the personnel are trained as Emergency Medical Technicians. CHP also has 22 aircraft for observation, assessment, and management. Finally, CHP has statewide or regional communications capabilities within its own agency.

CHP officers are normally used for short-term traffic control. However, they are occasionally used for long-term traffic control (of more than two weeks). Officers are also used for crowd or perimeter control, enforcement of road blocks, and emergency communications. Assignments usually involve scene management, perimeter control, evacuations, and monitoring or controlled areas (including issuance of car passes and escorts of property owners).

After an earthquake, the CHP will:
1. Check for obvious damage of highways, such as major cracks or lifting;
2. Perform a complete roadway assessment throughout the Bay Area;
3. Secure emergency vehicle routes;
4. Develop a traffic plan for each county, and, with the Metropolitan Transportation Commission, for major highways;
5. Regulate the movement of commercial vehicles;
6. Handle routine emergencies;
7. Establish and maintain perimeters around the disaster area; and
8. Establish communications with the outside world.

CHP has learned some valuable lessons from past disasters.

The Cypress Freeway – Loma Prieta Earthquake – This incident involved 39 intersections. It required 80-100 officers per shift to maintain the perimeter. Numerous agencies were involved, including the CHP, the Oakland Police Department, the Oakland Fire Services Agency, the Alameda County Coroner, the California Department of Forestry, both the Alameda County and State Office of Emergency Services, and Caltrans. The question came up – who is in charge? The first Unified Command structure was instituted. Overall, there were 42 fatalities and numerous injuries. There were also abandoned motor vehicles where it was unknown where the driver was. Much specialized equipment was required.

The 1997/1998 Floods in Contra Costa County – East-Bound SR-24 was closed at Orinda. I-680 was closed at Marina Vista. SR-4 was closed at Franklin Canyon, Railroad, Loveridge, Somersville, and Hillcrest. Kirker Pass, Marsh Creek and San Pablo Dam Roads were closed. Caltrans was tied up.

The Los Angeles Riots – The Los Angeles Police Department was primarily used for crowd control and looting protection. The National Guard was used to maintain perimeters around secured areas. The CHP was used for fire and ambulance escort and protection.

The Pope's Visit to San Francisco – CHP secured the bridge and city streets for 10 miles. In all, a total of 600 officers were used from CHP, the San Francisco Police Department, and military police.

The Nuclear Fuel Rod Shipment – This incident was a unified command with numerous agencies throughout California. There was a high potential for civil unrest, but none materialized. The Marin County CHP were responsible for the Golden Gate and San Rafael Bridges and used 80 officers. The Solano County CHP were responsible for the Carquinez Bridge and UC Davis and used 20 officers with 100 on back-up from the Contra Costa CHP. The Contra Costa CHP were responsible for the Benicia Bridge and Naval Weapons Station and used 92 officers.

Loveridge Flooding – The SR-4 undercrossing of Loveridge Road was flooded for 7 days. It took 2½ hours to detour around the flooded area. The Antioch and Pittsburg Police Departments, CHP, and Caltrans jointly developed a traffic plan which allowed for one-way movements and no cross traffic. It uses approximately 20 officers per shift to implement the plan.

During emergency planning for future large earthquakes, it is important to recognize the potential for transportation disruption on a ***massive*** scale. There will be a number of problems that will need to be addressed, including:

- Disruption of highways, and an inability to provide emergency services;
- Disruption of communications, such as occurred as a result of the Coalinga earthquake;
- Uncontrollable fires, due to housing too close to grassy hills, and associated problems with being unable to read, or even see, street signs while having difficulty breathing;
- Lack of water pressure to fight fires;
- Flooding due to collapsing water tanks and levees, and due to water main breaks;
- Natural gas leaks and explosions;
- Disruption of electrical power (including an inability to pump water or refill storage tanks);
- Looting;
- Hazardous materials spills and fires;
- Collapsing of major interchanges and portions of highways;
- Lack of parallel highways and bridges in the Bay Area; and
- Numerous accidents with injuries.

Problems with emergency personnel will include:

- Getting the call;
- Getting to work (due to damaged roadways, bridges down, fires, and other causes);
- Not having proper equipment or communications if off-duty;
- Needing to know the status of family members if on-duty;
- Obtaining long-term meals, water, and lodging;
- Lack of coordination between agencies;
- Major lack of communications between agencies;
- Fuel requirements for emergency vehicles and generators;
- The Metropolitan Transportation Commission (MTC) Trans Response Plan for the nine-county region has not been tested in a large earthquake; and
- The Caltrans Transportation Management Center is not fully operational.

Bus Transportation Issues Resulting From the Loma Prieta Earthquake

Jim Cater
AC Transit
Emeryville, California

The Night of the Quake

When the 1989 Loma Prieta earthquake occurred, AC Transit had three buses in notable locations:

- an O Line bus was west bound on the top deck of the Cypress Freeway;
- a 12 Line bus was west bound on 14th approaching the Cypress Freeway under-crossing; and
- an N Line bus was east bound on the Oakland-San Francisco Bay Bridge.

Following the earthquake, we performed a damage assessment of our facilities. We found cracks in most of our buildings, but no structural damage. Communications disruption occurred due to repeater sites being knocked out of alignment. There was no damage to either equipment or buses. We established the key damaged areas (the Cypress, the Bay Bridge, and the BART shut-down) and re-routed lines.

To reestablish our communications system, we worked with short-range radios (walkie talkies) with a range of approximately one mile. We also set up a mutual aid system using the Central Contra Costa Transit Authority (CCCTA), the ferry fleet, and, by the following day, Golden Gate Transit. We established routes from Jack London Square and the MacArthur BART stations to other BART stations. We cleared the area of passengers at Jack London Square at 2:00 a.m.! Our biggest problem was communication with the passengers. We also were concerned about crowd control.

During the following weeks:

- we set up new routes;
- we set up three buses at the request of the Oakland Police Department as temporary morgues; and
- we worked with the American Red Cross on a building-by-building basis to evacuate as they were inspected.

We discovered that it is extremely important to keep good records on workforce, equipment, and any other resource used for later reimbursement.

Other Major Events

We have experienced other major emergencies besides the Loma Prieta earthquake, including:

- the Oakland Hills fire;
- the Richmond Union Carbide chemical spill;
- the Fremont floods; and
- the Oakland Chemical spill at 98th and San Leandro Blvd.

After the Loma Prieta Earthquake

We have worked with a number of different agencies and organizations since the earthquake to improve our emergency response, including:

- Hayward Fire Department in their yearly table-top exercise for major fires, chemical spills and earthquakes;
- Hayward Police Department on the S.W.A.T. Hostage Exercise;
- City of Alameda resource identification for fuel and storage;
- Union City Fire Department;
- City of Oakland;
- Oakland Airport on a major accident evacuation;
- City of Richmond;
- American Red Cross on evacuation procedures for temporary shelters, and evacuation of the disabled community;
- Alameda County Office of Emergency Services; and
- Contra Costa County Office of Emergency Services.

We have also been extensively involved with the Metropolitan Transportation Commission (MTC) in their:

- emergency response plan;
- table-top exercises;
- mutual aid agreement;
- clearinghouse;
- development of an in-house emergency plan; and
- work on a mobile Central Dispatch Unit.

Earthquakes Disrupt Communications Along With Transportation

Chris Salkeld and Polly McKinley
Pacific Bell
San Ramon, California

A major earthquake on one of the large faults in the San Francisco Bay Area may cause problems with telephone communications along with the transportation system.

Telephone communications may be impacted primarily due to extreme congestion to the public switched network. Customers may experience significant dial tone delays. Call volumes will likely increase up to 300% of normal. As call volumes increase, the network will automatically engage a process known as Line Load Control which restricts a percentage of incoming calls into the impacted area, thus providing additional opportunities for local access by essential services such as fire and police. In this event, emergency response circuits will receive priority restoration. Telephone traffic will be automatically rerouted where redundancy is built into the network. If it becomes difficult to gain dial tone from your phone set, please be patient and stay on the line. You will be cued-up on a first come first served basis when a dial tone shortage condition exists.

Cellular and PCS telephones may not be a reliable alternative communications system, as these wireless services have at least one connection through the local network and will experience the same congestion. Additionally, if a cell serving a particular area becomes saturated, service to all users in that cell will be degraded. Satellite telephones on the other hand, do not rely on land-based communications.

The telephone industry is highly reliant on commercial power which will probably be unavailable for many days in some areas. Most backup emergency power provisions at the telephone facility locations will be functional. Central offices will automatically switch to emergency battery or generator power upon a commercial power failure. These facilities are also dependent on a supply of water for the air conditioning systems which cool the switching equipment.

There are a number of telephone facilities located in areas subject to severe shaking and high probability of ground failure. Pacific Bell, however, has building and equipment installation standards that minimize physical earthquake damage to its central offices. Some underground cables will be damaged by ground failure, but not in sufficient numbers to preclude switching alternatives. Minor damage to outside plant can be expected. Access for repair crews may be a major problem due to disruptions in the transportation system.

From a recovery perspective, Pacific Bell will activate its internal emergency management organization and begin immediate damage assessment and restoration activities based on pre-established and tested emergency plans.

Restoration priorities consist of:

- company circuits vital to restoration;
- national security;
- emergency response agencies;

- isolated communities; and
- essential community services.

Pacific Bell has established two Network Operation Centers – one in San Diego and a second in Sacramento to monitor the public switched network, tune it and provide redundancy. In addition, Pacific Bell has an Emergency Control Center in Sacramento and two Recovery Emergency Operation Centers (also in San Diego and Sacramento). Pacific Bell holds four emergency preparedness drills each year, two related to Northern California and two related to Southern California.

As a leader in the telecommunications industry, Pacific Bell established its Emergency Preparedness Department following the 1987 Whittier Narrows earthquake in Southern California and today continues to proactively manage emergency preparedness issues in full support of its state of the art communications system within California.

Gas and Electric Utility Needs for Post-Earthquake Transportation

William U. Savage
Seismologist
Geotechnical Services
Pacific Gas and Electric Company
San Francisco, California

In the aftermath of a significant, damaging earthquake, access to transportation using streets and highways is vitally important for safety and service restoration in the earthquake-affected areas. Gas and electric utility facilities are located along virtually every urban, suburban, and rural street, with highways and bridges providing direct links from community to community. Immediately following an earthquake, surface transportation is critical for:

- getting utility field personnel to the sites of safety hazards such as downed electric wires or leaking gas pipelines;
- moving injured personnel to medical facilities;
- getting utility inspectors to damaged or potentially damaged facilities such as substations, service centers, and office buildings for assessment and control; and
- relocating key personnel to emergency response centers.

Within a few hours of the earthquake, the needed numbers of skilled utility personnel, along with specialized vehicles, equipment, repair parts and other supplies, are mobilized into damaged areas to carry out repairs and service restoration. Utility service centers and warehouses are widely distributed throughout the service territory to provide not only for efficient routine maintenance activities, but for effective redundancies of supplies and equipment to draw on during emergencies. The utility emergency response personnel rely on the Highway Patrol, Caltrans, local police, and other transportation agencies for accurate information about road closures, emergency vehicle routing, and other access assistance.

PG&E prepares for earthquakes and other emergencies with response plans and exercises designed to enable personnel to take the most efficient and effective actions for safety and restoration. In addition, for more than a dozen years PG&E has been conducting a systematic evaluation of earthquake hazards affecting the service territory in central and northern California, and assessments of earthquake vulnerabilities of key buildings, substations, power lines, gas compressors and valve stations, and pipelines. The Loma Prieta earthquake in October of 1989 was a real-life demonstration of earthquake hazards and utility vulnerabilities, and provided key information and lessons to further guide and motivate the implementation of safety and performance improvements. PG&E has invested more than a billion dollars in replacing old pipelines, retrofitting damage-prone buildings, and upgrading substation equipment for improved earthquake performance. As a result, there will be fewer post-earthquake demands on the transportation system, and customers can expect fewer and shorter-duration service outages.

The Chevron Emergency Communications and Rally Plan: Where Will You Go at Noon the Day After a Major Earthquake?

Chris Wimmer and Mia Weller
Chevron Corporation
San Francisco, California

Introduction

The San Francisco Bay Area Rally Plan was developed to provide a means of emergency communication for Chevron employees, their families , and the company in the event of a large-scale Bay Area disaster (such as an earthquake) that disables normal means of communication and travel. By gathering at pre-determined locations, employees and family members will be able to request information about one another from specially-trained volunteers using two-way radios on the company channel. Sixteen of these locations, know as Rally Points, have been assigned throughout the Bay Area. The locations were determined with various factors in mind, including the concentration of home locations of employees, physically accessibility (especially in a disaster situation), and radio reception. Rally Points are located either at company facilities (such as parking lots) or at public parks.

Why Was This Plan Developed?

In a disaster situation, such as the Loma Prieta earthquake in October 1989, everyone's primary thoughts are of the family and loved ones. Not knowing the status of one's family creates increased anxiety in an already tense situation. By offering a means to communicate when normal communications, such as telephones and cellular phones, are unavailable, the company is more likely to have reassured and productive employees. Alter all, if we don't know that our families are okay, we aren't likely to be very concerned about helping the company recover. Additionally, information about company operations can be communicated via the Rally Plan so that after employees have secured their families and homes, they will know where and when to report to work.. As the Loma Prieta earthquake showed, travel and communications difficulties did greatly impact the well-being of Chevron employees. Although few Chevron employees ended up stranded for more than several hours, the anxiety of not knowing about the welfare of their families created extra stress in an already tense situation.

How Was the Plan Developed?

In early 1989, (before the Loma-Prieta Earthquake), personnel from various parts of the company came together, breaking the established patterns for the sake of a cohesive communication plan. The committee included those with emergency planning responsibilities from Facilities, Computer Services, Telephone-Microwave-Radio Group, Human Resources, Public Affairs, Research & Technology, Refining and Facilities.

The Rally Plan, as it came to be known, was developed to address the most basic of disaster recovery issues. It is well known that during a disaster, an employee's first thoughts are for their family. Given the geographic structure of the Bay Area and the demographics of our employees, it

is very likely that many employees will be trapped on the opposite side of the bay from their loved ones for several days.

Human Resources ran a report showing the home addressees of Chevron employees by zip code. By examining where employees live and work, fourteen sites were picked for gathering spots. Each of the sites is either at a Chevron work location or in a public park near where a large concentration of employees live. All sites have radio communications with all the other sites and should be easily accessible during a disaster. Recently we added equipment for cellular packet E-Mail services which has greatly increased our ability to transmit information.

How Will the Plan Work?

In case of a disruption of phone lines each employee and family member checks in to a site convenient to their location. Names and basic information are transmitted by radio, cell phone and radiomail (packet system) to all other sites. Each site posts the lists of names of those who have checked in elsewhere. Thus, John Doe can verify that Jane has checked in and is presumably OK. The Rally Sites will also be able to provide information about when, where and how employees should return to work. This will give Chevron some idea of the number of employees available to return to work.

Since the development of the program, each employee has received two mailings at their home address informing them of the program. Maps are provided showing locations of all the sites so that regardless of where they may be, employees can access any site. Rally Sites are staffed by volunteers from throughout the company. Department managers, mailroom clerks, computer specialists and geologists work side by side to open and maintain the Rally Points. Each Rally Point Coordinator, (RPC), lives within walking distance of their Rally Site and has been provided with extensive equipment. Full scale drills are held twice yearly and an additional classroom training day is provided to discuss such issues as disaster stress syndrome, earthquake preparedness and other topics of interest to RPCs.

Conclusion

We all hope, of course, that the Rally Plan will never need to be activated; but if it ever is, helping employees, their families, and the company communicate with one another after the disaster will be the most important link to survival and recovery for us all.

UPS:
Moving Goods Following Earthquakes

Dean Bullert
United Parcel Service – East Bay District

United Parcel Service dispatches thousands of vehicles in the Bay Area every work day; an earthquake impacting the transportation corridors and communities in this area is a major concern! In the last 3 years, we've gathered UPS representatives from Washington, Oregon, Sacramento Valley, Northern California, and our Corporate offices to formulate the Northwest Region Earthquake Response Plan. In brief, plans call for "hazard hunts", securing computer systems and dangerous objects, reassessing evacuation plans, alternate critical suppliers, and duck, cover, and hold training.

Communications can be a major obstacle after an earthquake. UPS has commercial band radios at our airport facilities that can be distributed to various command posts in the Bay Area. We also have a number of "direct connect" phones to be used during communication disruptions.

Safety Committees have developed "meet points" to help stranded on-road drivers gather in safe areas after an earthquake. Each driver has a local map highlighted with several designated sites. Criteria for site selection include:

- a large, open parking area,
- no overhead power lines,
- both pay phone and regular phone lines available,
- no adjacent buildings that could fall on the area,
- no local hazardous materials, and
- no need to cross a bridge or overpass in reaching the site.

A layered communication list is also furnished so that the gathered drivers can designate one person to communicate with dispatchers, minimizing the amount of calls and attempted calls.

The third phase of our Northwest Region Plan looks at ways UPS can help the communities we serve. United Parcel Service has assisted responses to hurricanes, floods, and tornadoes through a variety of services ranging from local delivery of much needed supplies to international flights of goods. UPS was instrumental in the cleanup following the Oklahoma City bombing. UPS even specially converted a jet to fly "Keiko", the whale, from Mexico to his new home in Oregon.

Preliminary talks with the Bay Area Chapter of the Red Cross led us to look at their need for logistic assistance in the first 7-10 days after a major earthquake. Our relationship was just forming when the New Year's flood of January 1997 struck the Central Valley of California. UPS scrambled to create a delivery service to aid the Red Cross in helping flooded communities. Drivers from Merced, Fresno, Sacramento, and the East Bay were dispatched to affected areas. A UPS representative was on-site at the Red Cross Job Headquarters to coordinate activities. Drivers, tractors, package vehicles, fuel, and dry or refrigerated trailers were donated.

After this successful initial involvement, UPS realized that a more proactive approach was needed for disaster relief – especially in the case of earthquakes. A Master Operating Plan was created and two UPS liaisons were trained by the Red Cross for deployment to Red Cross Job

Headquarters in the future. UPS donated and stages two 45 foot trailers to the Red Cross for use as State Response Vehicles. 10,000 square feet of our San Ramon building was also designated as a temporary Local Disaster Warehouse. To assist planning for major disaster responses in the Bay Area, UPS also joined the Corporate Logistics Support Network. The group is comprised of approximately 50 corporations and organizations whose goal is to examine and plan for possible logistic needs in future disasters – developing contacts and responses before disruptions occur.

The February 1998 floods in Santa Cruz County provided a second test of the UPS / Red Cross affiliation. The UPS liaison was notified Feb. 3rd and immediately initiated the Master Operating Plan. The next morning much of the liaison's work was complete when he showed up at the Millbrae Red Cross Job Headquarters. Several empty trailers were already staged at the Sacramento Disaster Field Service Center. Staging areas were prearranged for Red Cross vehicles at the UPS Oakland facility. Donated refrigerated trailers were cleaned and ready for dispatch and delivery to flooded areas. A resupply network was prepared to support shelters if the flooding became more extensive. Proactive planning proved to be very effective during this response.

United Parcel's East Bay District has developed contacts with the State Office of Emergency Services, Bay Area and National American Red Cross, California Highway Patrol, United Way Disaster Grant Committees, and the Association of Bay Area Governments to help prepare for earthquakes.

United Parcel Service realizes that during disasters a prepared business is an asset to a community – and an unprepared business can further drain already overburdened response services. UPS is the major delivery and warehousing service to many businesses; we realize that our level of preparedness and response involvement can directly effect the recovery process of the Bay Area.

Lessons from Loma Prieta – Corporate Transportation Issues

Bill Sherman
President, Total Spectrum Business Continuity Planning
Retired Earthquake Program Manager, Intel Corporation
San Jose, California

There were a total of 140 road closures caused by the Loma Prieta quake. Fortunately, due to the short (15 second) duration and remote location, most of them were on lightly traveled rural roads. There were actually few major failures directly affecting main commute routes. The most significant were the Bay Bridge, the collapse of the elevated Cypress Structure (a part of Interstate 80 in Oakland), and a major landslide blocking a portion of Route 17 between Santa Cruz and Los Gatos. Two of these were repaired or cleared within a month. The Cypress Structure, however, was not fully replaced until October, 1998, nine years later. There were also extensive landslides, liquefaction, viaduct and bridge failures, primarily in rural areas. Compared with the Northridge and Kobe earthquakes, we had minor disruptions to major population centers. In fact, the use of ferries in conjunction with expanded BART service to bypass the Bay Bridge, and the use of van pools to expedite commutes from Santa Cruz to the Santa Clara Valley were two of the more successful strategies to alleviate commute woes.

In October 1989, I was Earthquake Program Manager for Intel Corporation. I learned quickly the effect that limited Freeway crossing routes and traffic light outages could cause. I was called to inspect one of Intel's main manufacturing facilities about 20 minutes after the quake so it could be re-opened. It took 45 minutes to drive 2 miles across route 101. Several hours later when I retraced my path to inspect the rest of Intel's buildings, it took 75 minutes. One of our first post-earthquake actions was to distribute 26 bicycles in emergency containers at several buildings so critical travel could be expedited. Another experience I had was the hour and one half trip I had to get home after midnight due to non-functioning traffic lights. This compared to a typical trip of less than one half-hour. For safety, people were stopping at each traffic light. Another lesson had to do with parking garages where surface damage often resulted in closure by managers or authorities, causing commute difficulties for employees when they couldn't access their vehicles.

To put the lessons learned in perspective, I cited information from the recovery plan we developed at Intel based on our in-depth review of the event. The information was based on over three years of plan development including two full-scale recovery drills. The plan includes instructions to the responsible managers, telling them where to go and what to do in any serious emergency including a major earthquake. At Intel, there were four major groups involved in various aspects of moving people, equipment, supplies, and products locally, regionally, nationally, and internationally. They were all represented in our Transportation/Distribution Recovery Plan. Specifically, it included:

1. Names, addresses, and telephone numbers of all Intel managers, alternates, and employees necessary to address expected transportation issues.

2. Names, addresses, and emergency phone numbers of all external resources needed to address transportation issues. These included:
   - Travel agents for airlines, hotels, and car rental agencies.
   - The airline providing leased planes for Intel flights between Santa Clara and Folsom

- Santa Clara County hotels with Intel contracts
- Rental car agencies with Intel contracts
- Ridesharing agencies
- Public transit companies
- All freight forwarders or carriers involved in moving objects through the Bay area including import-export services at San Francisco Airport
- Local airports
- Helicopter companies and private pilot representatives that could be used during an emergency
- Major airlines having freight or passenger moving contracts with Intel
- The Customs Broker handling San Francisco import-export shipments along with alternates which could have to be used at other ports

3. A Checklist of actions which have to be done to address transportation issues in an emergency

These issues are documented within a site-wide plan devoted to getting the right decision-makers to an Emergency Operations Center where information will flow in and out and major decisions will be made during the recovery phase. The transportation plan is one of 31 separate organizational recovery plans coordinated to assure actions are taken in accordance with management's expectations.

Note - This presentation was adapted from a comprehensive report on the lessons learned by California Corporations from the Loma Prieta earthquake in 1989 presented to the delegates of the 4th International Conference on Corporate Earthquake Programs in Shizuoka Japan on November 11, 1998. This portion includes some perspective on the Loma Prieta transportation issues plus pertinent excerpts from a recovery plan developed as a result.